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THE EFFECT OF EXPLICIT CRITICAL THINKING INSTRUCTIONS ON ARGUMENTATIVE WRITING ACHIEVEMENT: AN EXPERIMENTAL INVESTIGATION

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Abstract

It has been recognized that critical thinking (CT) is an important skill in education, especially in secondary education. This conceptual approach is very important in the Moroccan EFL context, in line with today's 21st century skills. It is crucial for students to deepen their subject-specific knowledge, developing the ability to integrate, analyze and evaluate different sources to improve their argumentative writing and lifelong learning skills. The aim of this quasi-experimental study was to investigate the effect of explicit CT instructions on 2nd-year Baccalaureate Mathematical Science students' argumentative writing performance. Within a pre-post-test quasi-experimental design, 58 EFL students participated in this study and were divided into two groups: control (N=28) and experimental (N=30). The experimental group received explicit CT instructions, and the control group didn't. Pre- and post-test writing essays were administered to compare the two groups' achievements. The findings confirmed the hypotheses and revealed a significant correlation between explicit CT instructions and the writing performance of EFL students who received explicit CT instructions compared to their control counterparts. The study recommends that teachers and stakeholders take immediate action to find practical methods to help students enhance their CT skills and integrate them into their argumentative writing and other language skills.

Key words: Critical thinking, Argumentative writing, Explicit instructions

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INTRODUCTION

The progressive and demanding nature of our world makes it imperative that students, the future citizens of our society, go beyond the mere accumulation of knowledge; they must have advanced cognitive abilities such as CT, decision making and problem solving. Zoller (1993) emphasizes on the importance of nurturing these higher-order cognitive skills to facilitate the transfer of students' knowledge and skills, regardless of their future social function. The key to fulfilling this demand is to develop students' CT abilities in relation to argumentative writing, which are crucial for analysing unfamiliar situations, and thus enabling them to ask questions, solve problems, and make decisions in a logical reasoning process (Ennis, 1989; in Zoller et al., 2000).

An important motive of continuous improvement in global education involves a shift from predominantly traditional teaching methods focused on basic cognitive skills to an emphasis on higher order cognitive skills (Leou et al., 2006; Zoller, 1993, 1999). This shift should take into account incorporating critical thinking inquiry and integrating it to the EFL curriculum (Zoller, 1993). Despite efforts to incorporate these remedial concepts and supportive teaching strategies into teacher training and professional development, a large proportion remains unused in the classroom (Barak & Dori, 2005). Experienced teachers are also challenged to use instructional strategies that foster higher level thinking among students (Tobin et al., 1990).

The key to effective learning is to develop students' CT skills via explicit instructions to face challenges and find appropriate solutions. Cognitive strategies are perfectly aligned with students' input and thinking skills. Recent research has delved into students' cognitive abilities and strategies for

acquiring second and foreign languages (Brown, 2000), on which CT stands out as a cognitive skill, characterized by "self-directed, self-disciplined, self-monitoring, and self-disciplined thinking" (Paul & Elder, 2006, p. 1). Essentially, critical thinking is dynamic, learners employ purposeful cognitive processes, as well as systematic reflection on their own and others' perceptions, with the goal of clarifying and enhancing their understanding (Chaffee, 1992).

Proficiency in constructing arguments holds significant importance for learners within academic and professional settings. Mastery in this skill is essential for conducting research, excelling in assessments, and composing persuasive essays. Contemporary business companies prioritize the recruitment of individuals based on their competencies and attitudes, sometimes even requiring assessments of CT abilities. Consequently, equipping EFL students to embrace CT is tantamount to prepare them for success in academia, workforce, and everyday lives (Beniche et al., 2021, p.122). This can be achieved by effective explicit CT instructions in the argumentative writing context.

The primary purpose of education is to produce responsible, engaged citizens who are prepared to contribute meaningfully to their society—a gradual process that requires support from kindergarten through higher education. Training students' CT skills in the educational system empowers them to actively shape change in their immediate communities. Engaging students in society poses a significant challenge in today's educational environment, requiring persistence, communication, and positive participation in social development. In society, means of communication are tools of resolving issues, reducing conflict, exchanging information, and sharing relevant facts through CT integration, argumentative writing is no exception.

In our educational setting, it is still important for teachers to develop their students' CT skills. In a world marked by uncertainty and ambiguity, individuals have raised doubts and hesitations. Shaping trust, creating hope and facilitating real communication in individuals and institutions could be attained via enhancing students' CT skills. On the same token, Oliva et al. (2007) emphasize the central role of CT in human intelligence, as it serves as the basis for understanding new challenges, meaningful discussions and practices, and conducting scientific research. Therefore, CT skills should be incorporated in EFL classrooms in an early stage to grantee their advancement as learners grow up. In Moroccan context, research in this area is scarce and more investigations should be carried out. For this reason, the present study tried to bridge this gap. In this context, the research problem of the present study revolved around the effects and relationships of explicit CT instructions on argumentative writing of 2nd year Baccalaureate Mathematical science students. The focus was on investigating whether explicit CT instructions have a significant effect or are associated with developing argumentative writing performance of students.

Different approaches to teaching and learning have led the evolution of 21ST-century skills in education around the world. This transformation necessitates a shift in teaching approaches, with an emphasis on moving away from traditional rote learning toward inquiry-based methods based on real-world occurrences. Constructivist theory stresses the importance of students' participation in learning experiences that support knowledge production and enhance cognitive processes (Cobb, 1994). Boddy et al., 2003; de Bono, 1976; Ennis, 1989; Kuhn, 1999; Watts et al., 1997) have focused on developing learners' cognitive capacities. Different roles define concepts or skills differently, ranging from 'cognitive awareness' (Leou et al., 2006; Zoller, 2001) to 'independent learning' (Resnick, 1987; Zohar & Dori, 2003), and all discriminate between high and low thinking skills. Higher-order thinking, which is thought to be non-algorithmic and complicated, produces more answers that involve evaluation, analysis, reasoning, and self-organization (Resnick, 1987). This is congruent with Bloom et al (1956) classification of thinking skills; It includes levels beyond comprehension such as evaluation, analysis and synthesis. Analysis and synthesis learning experiences foster higher order skills in problem solving, reasoning, prediction, synthesis, and creative thinking (Wilks, 1995). Questioning, decision making, critical thinking, and systematic thinking are some other examples (Dillon, 2002; Zohar & Dori, 2003; Zoller et al., 2002).

Higher order thinking is defined in this study as a holistic term that includes the concept of critical thinking, which entails analysis, evaluation, and creation skills. It is viewed as a systematic process that employs meta-cognitive skills. Education is critical in training future citizens to participate actively and responsibly in modern society (Zoller, 1999). As a result, schools should be transformed into centres for the development of higher order thinking skills via explicit critical thinking instructions.

In the high school level, education should place an emphasis on the development of these skills within the context of argumentative writing. However, implementing educational ideas in classrooms is frequently difficult (Boddy et al., 2003). As a result, this study aimed to investigate the effect of explicit critical thinking instructions on the performance of students' argumentative writing in Moroccan EFL classrooms.

This study uses CT as a sample kind of higher order thinking that can be measured using verified and trustworthy research. Scholarly literature has identified CT as a skill to control our cognitive processes (Paul, 1996), or the theory of reasoning which focuses on establishing beliefs and practices, and includes abilities such as evaluating arguments, confronting new information with prior knowledge, and introducing information based on critical and reasoning skills (Linn, 2000). CT skills are thought to be essential for acquiring metacognitive awareness (Kuhn, 1999; Schraw, Crippen, & Hartley, 2006). It is defined by Watson and Glaser (1994) as: (1) a multidisciplinary approach emphasizing the importance of evidence in deciding truth; (2) understanding relevant inferences and logically analysing persuasive evidence; and (3) skills in applying these behaviours and knowledge. Furthermore, It is defined as a result-oriented, rational, and reflective assessment of decision-making and responsibility for acts and subsequent results (Miri et al., 2007).

Improving CT among students is crucial, especially because many students struggle with CT even in college (Halpern, 1998; Kuhn, 1999). It is essential for success in a quickly changing world marked by complexity and interconnection. Individuals are now expected to participate actively in rigorous research and decision-making in school and in everyday life. To that aim, as De Bono (1983) pointed out, training CT skills involves more than sufficient reasoning; strategies are required to stimulate consciousness. CT evaluation looks at both skills (analytical-evaluative-inferential capacity) and attitudes (learner motivation and propensity to meaningful think critically). Examining both dimensions is critical since it indicates the learner's proclivity to use CT in various settings, argumentative writing is no exception.

Recent research on CT screening in postsecondary students in nursing, mathematics, and science have concentrated on postsecondary students, but have paid less attention to high school science students (Ben-Chaim et al., 2000; Watts et al., 1997). Given the significance of developing CT in writing context, the goal of this study is to investigate the effect of explicit CT instructional practices on students' argumentative writing performance.

Argumentation in writing is a cognitive process like problem-solving, requiring CT skills to construct sound arguments. CT is a purposeful thinking involving interpretation, analysis, evaluation, inference, and explanation. Dong & Yue (2015) argue that the cognitive process of English writing is inseparable from developing CT skills. Their study found a correlation between students' CT abilities and their English writing performance, suggesting that enhancing CT skills is crucial for nurturing English writing abilities.

Dong and Yue (2015) emphasize the importance of critical thinking skills in English writing proficiency. They argue that these skills are crucial for analysing information, generating ideas, maintaining perspectives, making comparisons, assessing arguments, and solving problems. Bayat (2014) discovered a statistically significant association between the intellectual complexity of prospective instructors and their achievement in academic writing by evaluating 181 teachers across six departments in Turkey. Similarly, Afshar et al. (2017) discovered a strong link between 104 mainstream English students' critical thinking abilities and their English writing skills.

Recent studies have explored the relationship between CT skills and argumentative writing skills in Moroccan university students. Hellalet (2021) conducted a study on CTS in writing, assessing students' ability to communicate their viewpoints and support them with evidence. The study involved 40 semester 6 students from Chouaib Doukkali University's English department. The students' writings were reviewed and graded using Bloom's taxonomy of educational objectives. The research findings showed that university students revealed a low level of CT as manifested in their writing and they lack the ability to express their opinions and support them with relevant evidence. In a study conducted in Moroccan Preparatory Classes of Higher Engineering Schools, Omar Ibn Khattab, Meknes, Beniche et al. (2021) investigated the relationship between students' CT skills and argumentative writing skills. The

study used a correlational research approach, using a CT Test to assess students' CT skills and an argumentative writing essay on social networking and creativity. The findings showed a significant association between the two variables, indicating a relationship between CT skills and argumentative writing skills.

Nejmaoui (2019) conducted an experimental study on the impact of integrating critical thinking on learners' engagement in argumentative writing. 36 Moroccan EFL learners were divided into two groups: experimental and control. The experimental group was taught using critical thinking skills, while the control group was instructed without such skills. The study found that the experimental group significantly outperformed the control group in using credible evidence, addressing substitute arguments, supporting conclusions, and maintaining logical flow in their writings. These studies, taken together, illustrate the importance of critical thinking in English writing and inspire additional investigation into their relationships.

Given the importance of explicit CT instructions in in EFL classrooms, the main objective of this experimental study is to investigate the impact of explicit CT instructions on the quality of argumentative essay writing among 2nd year Baccalaureate Mathematical Science students. The study was guided by two research questions which are formulated as follow:

(1) What effect do explicit critical thinking instructions have on Moroccan EFL 2nd year Baccalaureate Mathematical Science students' argumentative writing performance?
(2) Is there any significant relationship between explicit critical thinking instructions and argumentative writing performance of Moroccan EFL 2nd year Baccalaureate Mathematical Science students?

RESEARCH METHOD

Research Design

This study lends itself to a quasi-experimental research design. It investigated the effects of explicit CT instructions on students' argumentative writing performance. The primary goal of the experimental design is to determine causal relationships. The present study examined the effect of explicit CT intervention on students' argumentative writing performance by comparing experimental and control groups participants' achievement.

Participants

The participants of this study included two classes of Mathematical Sciences from a public high school in Zagora (Morocco). The students were divided into two groups: the experimental group (n=30), whose teacher deliberately used explicit CT instructions and the control group (n=28), who had regular classes without any specialized intervention. All the participants had a baseline understanding of English language skills. They shared similar demographics and academic backgrounds.

Instruments

This study's instruments included an argumentative writing pre-test and post-test, as well as a training kit. The instructions were delivered by students' instructor to minimize biases and confounding variables, enhancing the validity of the study's outcomes. Participants were not given feedback on their writing since it was assumed that the interval between the pre-test and post-test would allow the answers to fade from their memories.

The argumentative writing prompt utilized in this study was meticulously designed to assess participants' abilities to construct coherent, well-supported arguments within a given context. Crafted to challenge CT skills, the prompts presented thought-provoking issues, compelling participants to articulate and defend their stance or perspective effectively. The prompts aimed to elicit structured and persuasive written responses implementing CT skills, namely: analysis, evaluation, use of evidence and creation. Moreover, the prompts' formulation ensured its relevance to the study's objectives while maintaining neutrality to prevent bias. Both pretest and posttest essays were graded based on the developed scoring rubric for evaluating CT in argumentative essays (Cottrel, 2017; Schwam, 2017; Stapleton, 2001; The Washington State University Center for Teaching, Learning and Technology, 2009; Yanning, 2017).

Procedure and Data Analysis

Prior to introducing explicit CT instructions, a pre-test was administered to participants. Both groups took the writing test to ensure they were comparable in writing ability. The task was required to be completed within 60 minutes timeframe. The writing prompt was about: "Girls are more intelligent than boys. *Do you agree with this idea? Give specific reasons and details to* support *your answer".*

Later on, the experimental group received explicit CT instructions, with a specific emphasis on analysis, evaluation, argument development, use of evidence, and creation skills during two months; a two hour-class each week. The aim of the instructions was to enhance participants' understanding and application of CT skills in the argumentative writing context. The intervention focused on the concept of CT and its implications in debates and argumentation. The objective of the first week was to explain the nature of an argument and its types and how to analyze it critically. Then, students acquired fundamental principles such as the analysis of arguments, evaluation of evidence, and the development of logical and persuasive arguments. Next, they also received instruction on how to systematically evaluate argumentative texts, recognize rhetorical techniques, and evaluate the reliability of sources. By engaging in peer review and employing Socratic questioning, they honed their ability to evaluate arguments and defend their own viewpoints. During the next sessions, participants used argumentative texts to familiarize themselves with the difference between deductive and inductive reasoning and how to analyze and evaluate them critically, and how to develop arguments and use of evidence as well as creation of new ideas and thoughts. Moreover, participants were guided through how to assess the plausibility and validity of deductive arguments, as well as the strength of inductive arguments including techniques for evaluating the soundness and validity of logical reasoning. Additional interventions were given to deepen the understanding of argument analysis and evaluation focusing on analyzing the validity and strength of arguments. Practical activities were introduced to practice assessing arguments used to support a thesis statement; in a real-world context.

Following the intervention sessions, a similar post-test task was administered, which was about: "*Do you agree with this statement? The internet is harmful to children. Give clear reasons and details to support your answer".* Two ratters from a different school scored both pretest and post-test essays based on the developed scoring rubric for evaluating CT in argumentative essays (Cottrel, 2017; Schwam, 2017; Stapleton, 2001; The Washington State University Center for Teaching, Learning and Technology, 2009; Yanning, 2017) (See appendix A). They didn't know about the objectives of the study and neither they evaluate the experimental or control group essays. A high inter-rater reliability of .83 ($p < .01$), indicates a strong correlation between the two assessors' assessments based on final scores given independently.

Meanwhile, the control group continued regular English classes without special interventions related to CT. After the intervention, post-tests were analyzed for any changes or improvements in argumentative writing performance compared to pre-test scores. The pre-and post-test data were analyzed using the SPSS (Statistical Package for Social Sciences) software. The descriptive and inferential statistics are used to compare the two groups' scores to determine any significant variations and compare pre-and post-test scores between the experimental and control groups.

FINDINGS AND DISCUSSION

Participants' Argumentative Essay Test Scores: Pre-test

The experimental group (N=30) showed a mean score of 2.15 (SD = 1.323) on the pretest argumentative writing essay. In contrast, the control group (N=28) showed a remarkably high score of 2.85 (SD = 1.301). These scores indicate that there is a difference in basic writing skills between the two groups, with the control group showing a higher average in the argumentative writing essay task. Scores in the experimental group ranged from 1 to 2.5, whereas scores in the control group ranged from 1 to 2. These differences in mean scores and variability between experimental and control groups at pre-test require careful consideration when determining the impact of subsequent interventions on writing skills.

Participants' Argumentative Essay Test Scores: Post-test

Post-test scores from the argumentative essay test were analysed to assess the effect of the intervention on writing skills in the experimental and control groups. The experimental group (N=30) showed

significant improvement in argumentative writing performance after the explicit CT intervention with a mean post-test score of 3.87 (SD = 2.531), significantly higher than their pre-test mean 2.15. In contrast, the control group (n=28) showed a significantly lower mean post-test score, decreasing their pre-test score from 2.85 to 2.49 (SD = 2,011). Scores (1-3) showed little difference in achievement compared to the experimental group.

These results highlight the effectiveness of the intervention in significantly improving argumentative writing performance in the experimental group. However, the significantly lower improvement in the control group suggests that targeted interventions are needed to achieve comparable improvement. The significant differences in post-test scores for both groups reflect individual differences in responses to the intervention and highlight the importance of explicit CT instructions to meet different learning needs and enhance the development of writing achievement. Furthermore, research should focus on the specific interventions that significantly contributed to the observed improvements, to enhance more effective instructional strategies to improve students' argumentative writing performance in relation to CT skills.

Paired Samples T-Test: Pretest and Post-Test of Experimental Group

A paired samples t-test was conducted in the experimental group between pre-test and post-test scores revealed a statistically significant difference ($t = 2.8$, $p < 0.05$). The difference between pre-test and post-test, the mean score was 1.60, indicates an overall improvement in argumentative writing performance after the explicit CT intervention. A standard deviation of 1.38 indicates a moderate change in individual achievement scores. The standard error of the mean was calculated as 0.24. T-value obtained reflected the observed change in scores from pre-test to post-test, it is unlikely that it happened by chance. In other words, the improvement of participants' writing performance was due to their development of CT skills.

Independent Samples Test: Control and Experimental Groups (post-test)

An independent sample t-test conducted between the control and experimental groups on post-test scores showed a statistically significant difference ($t = 3.29$, $p < 0.05$. Levene's Test for Equality of Variances showed a moderate difference in scores between the groups, with a coefficient of variance of (1.70. $p = 0.21$), this indicates that although there was some variability in scores, the assumption of equal variance was not significantly violated. The standard error of the difference between group means was calculated as 1.10, representing the average deviation of individual scores from their group means. The obtained t-value (3.29) indicates that the difference in post-test scores between control and experimental groups was not by chance. This statistically significant difference indicates the influence of the intervention on the experimental group (it had a direct effect on argumentative writing performance) compared to the control group. Thus, the findings validated the hypotheses of the study. Consequently, based on these findings, it can be inferred that enhancing students' CT skills may enhance the essay writing proficiency of EFL learners.

The findings of the study support the hypothesis that direct CT instruction influences EFL students' argumentative writing performance. This supports Halpern's (2014) findings, which show that only deliberate explicit instructions result in significant increase in meta-cognitive skills. Receiving direct instruction does not only foster CT skills, but also writing skills. This urges curriculum developers to consider explicit CT instructions in relation to developing EFL argumentative skills. Higher-order thinking should be presented to EFL students with low academic profiles, it is advised. It backs up Zohar and Dori's (2003) recommendation that instructors should involve students of all academic levels in higher-order thinking activities.

Fand (1989) believes that delivering such tasks to low-proficiency students can encourage them to learn. The findings of the study are consistent with established views on how cognitive strategies contribute to the development of language skills. In recent decades, there has been an increasing amount of research on the positive effects of CT on various language skills, especially writing. Assadi et al. (2013) examined the effect of CT on improving Iranian EFL students' writing skills. The results showed that CT instruction had a significant effect on the participants' writing performance. Similarly, Miri and Azizi (2018) examined the effect of teaching CT on Iranian EFL learners' essay writing and found a statistically significant improvement in their writing skills. Considering the strong relationship between

reading and writing skills (Winterrowd, 2000), his study suggests that CT not only has the potential to enhance EFL students' writing but also their reading abilities as well. In Moroccan context, Roujel and Zohri (2019) claimed that explicit CT instructions improve EFL students' reading comprehension skills.

On the other hand, several studies contradict the findings of the present study. One such study examined the skills of 34 nurses enrolled in a University of Ontario online course, specifically examining their perceptions of writing skills and the degree of CT they demonstrated though their participants' own writing skills increased significantly. This improvement did not translate into higher writing skills compared to junior students in arts at the same institution, which resulted in the absence of any direct relationship between online writing and varying degrees of CT. The study suggested a possible relationship between online writing, CT skills, and the structure of activities (Carter, 2008). Furthermore, Fahim and Hashtroudi (2012) examined the effect of teaching CT on Iranian EFL university students' argumentative expressions. The findings revealed that although critical thinking strategies can increase students' critical thinking, they do not necessarily increase students' argumentative writing performance.

CONCLUSION AND IMPLICATIONS

The findings of this study highlight the significant impact of explicit CT instructions on the argumentative writing performance of second-year baccalaureate mathematical science students. The experimental group that received targeted intervention, with an emphasis on CT skills, showed significant improvement in their argumentative writing performance compared to the control group. The intervention enhanced the CT skills necessary for effective argumentative writing. The findings highlight the potential of integrating explicit CT instruction into the EFL instructional curriculum to develop and refine EFL students' writing skills.

The results of the study suggest important pedagogical implications for EFL teachers and curriculum developers. Integrating explicit CT activities into the curriculum can help develop students' ability to construct strong arguments and strengthen their logical reasoning. Teachers should consider combining targeted interventions aimed at developing CT skills, thereby promoting holistic development of EFL students' writing skills. Instructional activities that focus on argument analysis, evaluation of evidence, and effective argument design can be particularly useful. Furthermore, a supportive learning environment that helps promote CT among EFL students, can significantly improve their argumentative writing abilities.

Future research could further explore the findings of this study. Examining the sustainability of observed trends in argumentative writing over time, following explicit guidelines for CT may yield valuable insights. Investigating the transferability of CT developed in argumentative writing to other different disciplines and areas of study requires further research. Furthermore, a nuanced perspective can be provided by examining the differential effects of different CT instructional approaches or strengths on aspects of argumentative writing skills. In addition, the inclusion of qualitative research such as interviews or focus groups discussion can provide deeper insights into students' perceptions and experiences of CT activities and their impact on writing skills. Continued research efforts in this area could contribute significantly to tailoring instructional strategies to the specific needs of EFL students, developing their CT skills, and enhancing their argumentative writing skills.

While this study provides significant findings, it does have some limitations that should be noted: First, the scope of the study was limited to a specific group—second-year Baccalaureate mathematical science students—with a small sample size. This limits the findings' wider application to bigger and more diverse student populations across different academic levels or specialties. Second, despite efforts to ensure group comparability, external factors influencing students' writing talents may have differed across the control and experimental groups, potentially altering the study's conclusions. Third, the evaluation relied on standardized measures to measure argumentative writing, which may have overlooked key parts of students' writing skills that these tools did not capture. Finally, the study only targeted mathematical science students, limiting understanding of how specific CT instructions could improve argumentative writing performance in other academic subjects. These limitations do not decrease the quality of the findings but highlight the importance of cautious interpretation of the study's

findings and point to areas for further inquiry and improvement in future research.

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